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(73) Proprietor : **DIGITAL EQUIPMENT CORPORATION**
111 Powdermill Road
Maynard Massachusetts 01754-1418 (US)

(72) Inventor : **Friedman, Harvey S.**
27 Middle Road
Sudbury Massachusetts 01776 (US)

(74) Representative : **Goodman, Christopher et al**
Eric Potter & Clarkson
St. Mary's Court
St. Mary's Gate
Nottingham NG1 1LE (GB)

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Jouve, 18, rue Saint-Denis, 75001 PARIS

Description

FIELD OF THE INVENTION

This invention relates generally to the field of packaging for electronic components such as semiconductor chips and, more particularly, to packaging which serves as a sink for heat generated by the chips.

BACKGROUND OF THE INVENTION

Recent advances in semiconductor manufacturing technology have resulted in the increased miniaturization of integrated semiconductor components, generally known as "chips". The new chips are able to perform more complex functions, and at a faster rate, than their predecessors, yet are often the same size, or smaller. In order to perform these complex functions, the new chips consume more power than their predecessors and, as a consequence, generate more heat. This is significant because most chips should be operated below 100°C. If a chip becomes too hot, the semiconductor junctions, which constitute the basic electrical elements within the chip, have a tendency to break down and the chip may malfunction. Thus, it is necessary to efficiently extract the heat, or otherwise cool the chips, while they are operating to insure that they continue to function properly.

Thermal packages have been provided for chips which, in addition to providing chips with protection, include a means for extracting the heat generated by the chips. Inside the chamber is some type of heat transfer device, such as pistons or other members formed of thermally conductive material, that are each in contact with a seperate chip and are all in contact with an external heat sink. The external heat sink usually comprises either a set of cooling fins that are integral with the outer surface of the package, or a cold plate with liquid circulating therethrough. The heat generated by the chips is extracted by the heat sink through the heat transfer devices.

In order for heat to readily flow from the chip through the heat transfer device, there should be a minimal amount of thermal resistance between the chip and the heat transfer device. Consequently, the heat transfer device must be in physical contact with the chip. Many thermal packages are provided with heat transfer devices that are biased against the adjacent chips by springs or other mechanical devices. These devices thus exert a stress-inducing force on the chip. This stress may be aggravated due to the repetitive thermal expansion and contraction of the heat transfer device as the quantity of heat passing through it varies, causing the heat transfer devices to expand and contract at a rate different than those of the chips they are in contact with. Moreover, the heat transfer devices may further stress the chips they are in contact with by imparting external strains and transmitting mechanical vibrations. These stresses may occur both in the normal operation of the device or as a consequence of movement of the device such as in shipping or installation. Over time, the changes in mechanical stress may fatigue the chips so that they are torn loose from the circuit they are attached to, break, or are otherwise rendered useless.

Furthermore, the heat transfer devices should be in good physical contact with the external heat sink in order to maintain good thermal conductivity therebetween. To provide the necessary contact, many thermal packages are integral assemblies wherein the chip, the heat transfer device and the external heat sink cannot be readily disassembled from each other. This type of assembly makes it difficult to perform maintenance on just one part of the package. For instance, if a chip in the package malfunctions, it may be difficult to gain access to it so it may be replaced, and so the entire package may have to be replaced. This situation would add to the overall cost of operating a device that contains this type of thermal package.

Moreover, many new chips need to be supplied with a relatively high drain voltage level in order to insure their efficient operation. Normally this voltage is supplied by conductors on the printed circuit board to which the chip is attached. In a thermal package, the chip may be attached to a small-sized printed circuit board within the package that may not have sufficient space to accommodate the conductors necessary to supply the drain voltage.

Another consideration in the packaging of semiconductor chips is that frequently the chips attached to a particular circuit generating the same amount of heat are subjected to differing cooling conditions. This may be because of their locations in the circuit that they are part of. For instance, a chip closer to a cooling source, such as a fan or an opening, may operate at lower temperature than a chip further away. When this occurs, signal transmission between chips may be degraded because of differing voltage levels and noise margins on the chips as a result of their being operated at substantially different temperatures.

IBM Technical Disclosure Bulletin, vol.21, no.6, November 1978, page 2431, New York, US, V.W. Antonetti et al, entitled "Compliant Cold Plate Cooling Scheme", discloses a module packaging arrangement using a cold plate having a multiplicity of wells, each containing a thermally conductive piston. Springs push the pistons against the modules, i.e. the electronic components. Rubber bellows with a thermally conductive compound, are also used about the pistons. The arrangement purportedly assures low thermal interface resistance and good heat transfer, and provides viscous damping. EP-A-0103068 provides an alternative packaging arrangement.

SUMMARY OF THE INVENTION

This invention is set out in Claim 1 and provides a new and improved thermal package for semiconductor chips.

The thermal package of this invention includes one or more chips mounted on a printed circuit interconnect substrate and attached thereto by flexible leads, such as Tape Automated Bonding, (TAB), leads. A pliant foam pad is attached to the surface of each chip adjacent the printed circuit interconnect substrate. A heat spreader is attached to the top of each of the chips above the printed circuit interconnect substrate. The heat spreaders are secured to a support plate that is mounted above the printed circuit interconnect substrate. A heat sink, such as a cap with cooling fins, or a cold plate, is attached to the top surface of the support plate. The heat spreader is made of a material that has good thermal conductivity characteristics and the substantially same thermal coefficient of expansion as the chips.

The heat spreaders are mounted in bores formed in the support plate, and secured therein by a ring and clamp assembly that biases the top of the heat spreaders against the heat sink.

Electrical conductors are provided on the surface of the support plate adjacent the printed circuit interconnect substrate. The heat spreaders have conductors on their outer surfaces that provide an electrical connection between the support plate conductors and electrical bond points on the top surface of the chips.

When the thermal package is assembled, the chips therein are protected from external forces. A voltage can be supplied to the chips through the conductors in the support plate and the heat spreader. Since the chips are firmly attached to the heat spreader, and the heat spreader is urged against the external heat sink, heat generated by the chips readily flows through the heat spreader to the external heat sink.

Furthermore, each chip is provided with an individual heat spreader that efficiently conducts heat away therefrom towards the heat sink regardless of its position in the thermal package. Each heat spreader operates independently of the others, so that chip to chip temperature differences can be minimized. As a result, subsequent voltage and noise variations between the chips can similarly be reduced.

The heat spreaders do not exert any substantial stress on the chips. This is because the heat spreaders and chips are attached together and the clamp and ring assembly biases the chip-and-heat spreader sub-assembly away from the printed circuit interconnect substrate. Any movement by the chip and heat spreader sub-assembly relative to the printed circuit interconnect substrate is tolerated by the flexibility of the TAB leads.

Moreover, the individual heat spreaders will each be in physical contact with the surface of the heat sink regardless of any planarity variations of the heat sink surface.

Since the heat spreader is normally biased against the heat sink, the two do not have to be attached together with permanent fasteners in order to maintain firm physical contact, and good thermal transfer characteristics therebetween. Fasteners, such as screws, can be used to attach the heat sink to the thermal package. This makes it possible to assemble this thermal package so that it can be readily taken apart if it is necessary to perform maintenance or replace the chips therein.

BRIEF DESCRIPTION OF THE DRAWINGS

This invention is pointed out with particularity in the appended claims. The above and further advantages of this invention may be better understood by referring to the following description taken in conjunction with the accompanying drawings, in which:

Figure 1 is a top view, partially cut away, illustrating the thermal package of this invention.

Figure 2 is a cross-sectional view of the thermal package of this invention with a chip mounted therein.

Figure 3 is a cross-sectional illustration of a flex seal spring of Figure 2 used to bias the heat spreader towards the external heat sink according to this invention.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 illustrates a thermal package 10 constructed in accordance with this invention which contains a number of chips 12 mounted on a printed circuit interconnect substrate 14. The printed circuit interconnect 14 is affixed to base plate 16 which is formed of a material which matches the thermal coefficient of expansion of the printed circuit interconnect substrate 14, such as a polyimide-copper composite. Heat spreaders 18, each with a substantially cylindrical profile and a planar top surface 19, are attached to the major surfaces of the chips 12 above the printed circuit interconnect 14. The heat spreaders 18 are secured to a support plate 20, with a planar top surface 21, that forms a number of spreader bores 24 to accommodate the individual heat spreaders 18. An external heat sink, such as a cooling fin plate 28, having a planar bottom surface 30 (figure 2), is attached to support plate 20 so the heat sink bottom surface 30 (figure 2) abuts the spreader top surfaces 19 (figure 2).

As depicted in Figure 2, each chip 12 is provided with a pliant foam pad 32 that is affixed to the surface of the chip 12 on which the components are formed, the active surface, which is adjacent the printed circuit interconnect substrate 14. Tape Automated Bonding, (TAB), leads 33, formed on a section of film, which are relatively flexible, electrically connect bond points on the chip 12 (not illustrated) to conductors on the printed circuit interconnect 14.

Each heat spreader 18 is formed from a ceramic or other material with good thermal conductivity characteristics and the same thermal coefficient of expansion as the chip 12 it is attached to. One type of material that the heat spreaders 18 may be formed from is high thermal conductivity silicon-carbide ceramics. The heat spreader 18 has a bottom planar surface 34 that the chip 12 is bonded to. The chips 12 and heat spreaders 18 are bonded together by an adhesive 37 with good thermal conductivity characteristics, such as some epoxies or solder. The heat spreader bottom planar surface 34 is part of a heat spreader bottom section 36 that subtends a cross-sectional area greater than that subtended by the main body of the heat spreader 18.

The support plate 20 is formed from a material, such as a beryllium-copper alloy, that has a thermal coefficient of thermal expansion identical to that of the cooling fin plate 28 and the base plate 16. A stepped annular lip 38, integral with the support plate 20, extends into each spreader bore 24 adjacent the printed circuit board 12. The annular lip 38 defines a bottom opening 40 with a cross-sectional area less than that of the spreader bottom section 36. The chip 12 and heat spreader 18 subassembly are secured to the support plate 20 by a clamp 41 and flex spring 42. The flex spring, shown in more detail in Figure 3, has a coiled spring 43 encased within a rubber ring 44. The flex spring is disposed around the heat spreader 18 above the annular lip 38 of the support plate 20. The clamp 41 is a split-ring with a threaded space 46 used to accommodate an insertion tool. The clamp 41 is secured to the outer circumference of the heat spreader 18 and disposed so the flex spring 42 is compressed between the clamp and the support plate annular lip 38. The threaded space 46 includes a cam feature to facilitate the clamping action of the clamp 41 around the heat spreader 18.

The surface of the support plate 20 proximate the printed circuit interconnect 14 is provided with one or more conductors 50 that extend to the bottom openings 40. The conductors 50 may be insulated from the support plate 18 and each other by a polyimide film or other suitable insulator,(not illustrated). The conductors 50 are electrically connected to associated spreader conductors 54 that have been deposited, utilizing suitable metalization techniques known in the art, onto the surface of the spreader bottom sections 36, including on the planar bottom surface 34. The electrical connection between support plate conductor 50 and the spreader conductor 54 may be made using suitable compliant conductive member 55 such as electrical conductive elastomer section or metal springs. The spreader conductors 54 are maintained in electrical contact with bond points on the major surface of the chips 12 through physical contact, soldering, or an electrically conductive adhesive.

The printed circuit interconnect substrate 14 is provided with a number of external leads (not shown) for electrically connecting the chips 12 to the circuit they are to be attached to. One or more openings, not illustrated, are provided in the base plate 16 to accommodate the leads (not shown).

The thermal package 10 may be assembled by first bonding the chips 12 to the spreader bottom sections 36 and the printed circuit interconnect substrate 14 to the base plate 16. Standard TAB bonding techniques are used to connect the chips 12 to the printed circuit interconnect substrate 14. The heat spreaders 18 are then attached to the top of the chips 12. The support plate 20 is then located over the heat spreaders 18, and the clamps 41 and flex springs 42 are inserted over the heat spreaders 18 to secure them to the support plate 20. The cooling fin 28, or other heat sink, may then be attached to the support plate top major surface 21.

Alternatively, the thermal package 10 may be assembled by first TAB bonding the chips 12 to the printed circuit interconnect substrate 14. The heat spreaders 18 are then mounted to the support plate 20 with the clamp 41 and flex spring 42 subassembly. The heat spreaders 18 and support plate 20 subassembly is then gang bonded to the chips 12.

When this thermal package 10 is assembled, the chips 12 and printed circuit interconnect substrate 14 are protected from external forces by the base plate 16, the support plate 20 and the cooling fin plate 28. A voltage may be supplied to the chips 12 through the plate conductors 50 and the spreader conductors 54. The heat spreaders 18 serve as heat transfer devices and heat generated by the chips 12 readily passes through them to the cooling fin plate 28.

The flex springs 42 urge the clamps 41 and heat spreaders 18 attached thereto away from the support plate bottom openings 40 so that the heat spreader top surfaces 21 are biased against the heat sink bottom surface 30. Since the chips 12 are attached to the spreader bottom planar surfaces 34 and the heat spreaders are biased away from the printed circuit interconnect substrate 14, the heat spreaders 18 do not exert any force on the chips 12. Also, the chips 12 and heat spreaders 18 have the same coefficient of thermal expansion, so contraction or expansion of the chips 12 and heat spreaders 18 caused by changes in the heat flux therethrough will be identical. Therefore, the stress on the chips 12 caused by the contact of the heat spreaders 18 against them is minimal. Since a foam pad 32 is attached to each of the chips 12, and the chips 12 are connected to the printed circuit interconnect substrate 14 by the flexible TAB leads 33, vertical and horizontal movement relative to the printed circuit interconnect substrate 14 during installation, and due to thermal expansion and contraction, is tolerated. Thus, the chips 12 housed in the thermal package 10 are subject to virtually no mechanical stress that over time can cause the chips to become fatigued and rendered useless.

Also, each chip 12 housed in this package 10 is attached to a separate heat spreader 18 that serves as a path for the efficient conduction of heat away therefrom regardless of its position in the package 10 so the temperature differences between the chips 12 will be minimized. As a result, subsequent voltage and noise variations between the chips, that are the result of temperature variations are similarly reduced.

Furthermore, when the thermal package 10 is assembled by first installing the chips 12 on the printed circuit interconnect substrate 14 and then mounting the heat spreaders 18 and support plate 20 subassembly to that subassembly, the heat spreaders 18 may be precisely positioned with respect to the support plate 20. This makes providing the electrical connection between the support plate conductors 50 and the spreader conductors 54 a relatively simple task. Also, this assembly process allows the use of standardized components and can be readily performed by automated assembly equipment resulting in economies cost of both components and assembly.

Moreover, since the printed circuit interconnect substrate 14, the base plate 16, and the support plate 20 have substantially identical coefficients of thermal expansion, these components will not stress each other as the heat generated by the chips 12 changes.

Another advantage of this thermal package 10 is that the action of the clamps 41 and flex springs 42 biasing the heat spreaders 18 against the heat sink bottom planar surface insures there is good mechanical contact, and hence thermal conductivity between the heat spreaders 18 and the cooling fin plate 28. Since the heat spreaders 18 are normally biased against the cooling fin plate 28, the package can be assembled with fasteners, such as screws, that allow for the quick disassembly of the package 10. This makes repair and replacement of the portion of the thermal package 10 containing the chips 12 a relatively simple task. This is especially important if the thermal package 10 has a cold plate with recirculating coolant instead of a cooling fin plate 28 as a heat sink; the package 10 can be disassembled for repair without disconnecting the cold plate from its associated piping. Moreover, since the cooling fin plate 28, or other heat sink is not rigidly attached to the package 10, it will not stress the package 10 as the heat generated by the chips 12 fluctuates.

Furthermore, the clamps 41 compress the flex spring's rubber rings 44 (Fig. 2) against the outer circumference of the heat spreaders 18 and the walls defining the spreader bores 24. The flex spring 42 thus also serves as a seal to keep contaminates away from the chips 12 and printed circuit interconnect substrate 14. Moreover, the foam pad 32, adjacent the active surface of the chip 12 seals the components fabricated thereon so as to prevent their degradation due contact with environmental contaminants.

It is understood that this description is for the purposes of illustration only, and alternative embodiments of this invention are possible. For instance, as previously mentioned, a cold plate rather than the cooling fin plate 28 can be used as the external heat sink. The operation of the thermal package 10 is independent of the type of printed circuit interconnect substrate provided. The thermal package may be used to house and extract heat from a single chip as well as multiple chips. In some embodiments of the invention it may be desirable for reasons of design efficiency and economy to attach more than one chip to each heat spreader. Alternative methods of securing the heat spreaders 18 to the support plate so they are urged against the heat sink may be used. Also, the thermal package 10 may have more than one plate conductor 50 and spreader conductor 54 per chip 12 in order to supply multiple voltages thereto.

Claims

1. An assembly housing at least one electronic component (12), said assembly comprising:

   a. a printed circuit interconnect substrate (14) to which said electronic component is electrically connected;

   b. a heat spreader (18) having a bottom surface (34) and a top surface (19); and

   c. a support plate (20) spaced away from said printed circuit interconnect substrate (14) having a top surface (21) and a bottom surface, said support plate (20) defining a spreader bore (24) in which said heat spreader (18) is disposed; and characterised by:

   d. a heat sink (28) attached to said support plate (20) and having a bottom surface (30) adjacent to said support plate top surface (21);

   e. said spreader bore (24) being a through-hole in said support plate (20);

   f. the length of said spreader (18) exceeding the thickness of said support plate (20);

   g. said electronic component (12) being bonded to said spreader bottom surface (34) so as to form a component-and-spreader subassembly, and said electronic component (12) being connected to said printed circuit interconnect substrate (14) by means including a plurality of flexible leads (33);

   h. spring fastening means (42, 43) for securing said component-and-spreader subassembly to said support plate (20) and for urging said spreader top surface (19) against said heat sink surface (30).

2. The assembly in accordance with claim 1 further characterised by a pliant foam pad (32) disposed between said electrical component (12) and said printed circuit interconnect substrate (14).

3. The assembly in accordance with claim 1, further characterised by:
    a. said heat spreader (18) having a substantially cylindrical profile, and said spreader bore (24) being defined by a substantially cylindrical perimeter;
    b. an annular lip (38) extending from said support plate (20) into said spreader bore (24) so as to define an opening (40);
    c. said heat spreader (18) including a bottom section (36) adjacent to said printed circuit interconnect substrate (14) with a cross-sectional area greater than that of said opening (40); and
    d. said heat spreader (18) being disposed in said opening (40) such that said spreader bottom section (36) is disposed between said support plate (20) and said printed circuit interconnect substrate (14).

4. The assembly in accordance with claims 1 or 3, further characterised by said spring fastening means (42) including a resilient member (42,43) disposed around said heat spreader (18) in said spreader bore (24) and adjacent to said annular lip (38), and a clamp (41) secured to said heat spreader (18) and disposed between said resilient member (42,43) and said heat sink (28) so that said resilient member (42,43) urges said clamp (41) and said heat spreader (18) towards said heat sink (28).

5. The assembly in accordance with claim 4, further characterised by said resilient member (43,44) including a rubber ring (44), and a coiled spring (43) disposed within said rubber ring (44).

6. The assembly in accordance with claims 1 or 3, further characterised in that:
    a. a conductor (54) is provided on said heat spreader (18), said conductor (54) being in contact with said electronic component (12);
    b. a conductor (50) is provided on said support plate (20), said conductor (50) being electrically connected to said heat-spreader conductor (54) so as to define an electrical path from said support plate (20) to said electrical component (12).

7. The assembly in accordance with claim 6, further characterised by said support-plate conductor (50) being at least partially disposed on said bottom surface of said support plate (20).

8. The assembly in accordance with claim 1, further characterised by a base plate (16) attached to said printed circuit board interconnect substrate (14), and disposed such that said printed circuit board interconnect substrate (14) is disposed between said electronic component (12) and said base plate (16).

9. The assembly in accordance with any of the claims 1-8, further characterised by said heat spreader (18) having substantially the same thermal coefficient of expansion as the electronic component (12).

Patentansprüche

1. Aufbau, in dem wenigstens ein elektronisches Bauelement (12) untergebracht ist, wobei der Aufbau umfaßt:
    a. einen Platinenverdrahtungsträger (14), mit dem das elektronische Bauelement elektrisch verbunden ist;
    b. einen Wärmeverteiler (18) mit einer Unterseite (34) und einer Oberseite (19); und
    c. eine im Abstand von dem Platinenverdrahtungsträger (14) angeordnete Trägerplatte (20) mit einer Oberseite (21) und einer Unterseite, wobei die Trägerplatte (20) eine Verteilerbohrung (24) abgrenzt, in der der Wärmeverteiler (18) angeordnet ist; und wobei der Aufbau gekennzeichnet ist durch:
    d. einen Kühlkörper (28), der an der Trägerplatte (20) befestigt ist und der eine Unterseite (30) hat, die an die Oberseite (21) der Trägerplatte angrenzt; wobei
    e. die Verteilerbohrung (24) ein Durchgangsloch in der Trägerplatte (20) ist;
    f. die Länge des Verteilers (18) die Dicke der Trägerplatte (20) übersteigt;
    g. das elektronische Bauelement (12) mit der Verteilerunterseite (34) verbunden ist, um eine Bauelement-Verteiler-Baugruppe zu bilden, und das elektronische Bauelement (12) durch Mittel, die eine Vielzahl von flexiblen Anschlußdrähten (33) umfassen, mit dem Platinenverdrahtungsträger (14) verbunden ist; und durch
    h. eine Federbefestigungseinrichtung (42, 43), um die Bauelement-Verteiler-Baugruppe an der Trägerplatte (20) festzuhalten und um die Verteileroberseite (19) in Richtung auf die Kühlkörperseite (30) zu treiben.

2. Aufbau nach Anspruch 1, der weiterhin durch ein elastisches Schaumkissen (32) gekennzeichnet ist, das zwischen dem elektronischen Bauelement (12) und dem Platinenverdrahtungsträger (14) angeordnet ist.

3. Aufbau nach Anspruch 1, der weiterhin dadurch gekennzeichnet ist, daß:
   a. der Wärmeverteiler (18) ein im wesentlichen zylindrisches Profil aufweist und die Verteilerbohrung (24) von einem im wesentlichen zylindrischen Umfang abgegrenzt wird;
   b. eine Ringlippe (38) sich von der Trägerplatte (20) aus in die Verteilerbohrung (24) hinein erstreckt, um eine Öffnung (40) abzugrenzen;
   c. der Wärmeverteiler (18) einen an den Platinenverdrahtungsträger (14) angrenzenden Bodenteil (36) mit einer Querschnittsfläche umfaßt, die größer als diejenige der Öffnung (40) ist; und
   d. der Wärmeverteiler (18) so in der Öffnung (40) angeordnet ist, daß der Verteilerbodenteil (36) zwischen der Trägerplatte (20) und dem Platinenverdrahtungsträger (14) angeordnet ist.

4. Aufbau nach Anspruch 1 oder 3, der weiterhin dadurch gekennzeichnet ist, daß die Federbefestigungseinrichtung (42) ein federndes Element (42, 43), das um den Wärmeverteiler (18) herum in der Verteilerbohrung (24) angeordnet ist und an die Ringlippe (38) angrenzt, und eine Klemmvorrichtung (41) umfaßt, die an dem Wärmeverteiler (18) befestigt ist und zwischen dem federnden Element (42, 43) und dem Kühlkörper (28) angeordnet ist, so daß das federnde Element (42, 43) die Klemmvorrichtung (41) und den Wärmeverteiler (18) in Richtung auf den Kühlkörper (28) treibt.

5. Aufbau nach Anspruch 4, der weiterhin dadurch gekennzeichnet ist, daß das federnde Element (43, 44) einen Gummiring (44) und eine innerhalb des Gummirings (44) angeordnete Spiralfeder (43) umfaßt.

6. Aufbau nach Anspruch 1 oder 3, der weiterhin dadurch gekennzeichnet ist, daß:
   a. auf dem Wärmeverteiler (18) ein Leiter (54) vorgesehen ist, der mit dem elektronischen Bauelement (12) in Kontakt steht;
   b. auf der Trägerplatte (20) ein Leiter (50) vorgesehen ist, der mit dem Wärmeverteiler-Leiter (54) elektrisch verbunden ist, um einen elektrischen Weg von der Trägerplatte (20) zu dem elektronischen Bauelement (12) zu bilden.

7. Aufbau nach Anspruch 6, der weiterhin dadurch gekennzeichnet ist, daß der Trägerplattenleiter (50) wenigstens teilweise auf der Unterseite der Trägerplatte (20) angeordnet ist.

8. Aufbau nach Anspruch 1, der weiterhin durch eine Grundplatte (16) gekennzeichnet ist, die an dem Platinenverdrahtungsträger (14) befestigt ist und die so angeordnet ist, daß der Platinenverdrahtungsträger (14) zwischen dem elektronischen Bauelement (12) und der Grundplatte (16) angeordnet ist.

9. Aufbau nach einem der Ansprüche 1 - 8, der weiterhin dadurch gekennzeichnet ist, daß der Wärmeverteiler (18) im wesentlichen den gleichen Wärmeausdehnungskoeffizienten wie das elektronische Bauelement (12) hat.

Revendications

1. Ensemble logeant au moins un composant électronique (12), ledit ensemble comprenant ;
   a. un substrat d'interconnexion de circuit imprimé (14) auquel ledit composant électronique est relié électriquement;
   b. un diffuseur de chaleur (18) comportant une surface inférieure (34) et une surface supérieure (19); et
   c. une plaque de support (20) espacée d'une certaine distance dudit substrat d'interconnexion de circuit imprimé (14) et possédant une surface supérieure (21) et une surface inférieure, ladite plaque de support (20) définissant un trou de diffuseur (24) dans lequel est disposé ledit diffuseur de chaleur (18); caractérisé par :
   d. un dissipateur de chaleur (28) fixé à ladite plaque de support (20) et comportant une surface inférieure (30) adjacente à la surface supérieure (21) de ladite plaque de support;
   e. ledit trou de diffuseur (24) consistant en un trou traversant défini dans ladite plaque de support (20);
   f. la longueur dudit diffuseur (18) étant supérieure à l'épaisseur de ladite plaque de support (20);
   g. ledit composant électronique (12) étant lié à la surface inférieure (34) dudit diffuseur de manière à définir un sous-ensemble formé du composant et du diffuseur, et ledit composant électronique (12) étant relié audit substrat d'interconnexion de circuit imprimé (14) à l'aide de moyens comprenant plusieurs fils flexibles (33); et
   h. des moyens de fixation élastiques (42, 43) destinés à assujettir ledit sous-ensemble for-

mé du composant et du diffuseur à ladite plaque de support (20) et à solliciter la surface supérieure (19) dudit diffuseur contre la surface (30) dudit dissipateur de chaleur.

2. Ensemble selon la revendication 1, également caractérisé par un patin en mousse flexible (32) disposé entre ledit composant électrique (12) et ledit substrat d'interconnexion de circuit imprimé (14).

3. Ensemble selon la revendication 1, également caractérisé par le fait que :

a. ledit diffuseur de chaleur (18) présente un profil sensiblement cylindrique, et ledit trou de diffuseur (24) est délimité par un périmètre sensiblement cylindrique;

b. un rebord annulaire (38) s'étend depuis ladite plaque de support (20) jusque dans ledit trou de diffuseur (24) afin de définir une ouverture (40);

c. ledit diffuseur de chaleur (18) comprend une section inférieure (36) adjacente audit substrat d'interconnexion de circuit imprimé (14) ayant une surface en section transversale supérieure à celle de ladite ouverture (40); et que

d. ledit diffuseur de chaleur (18) est disposé dans ladite ouverture (40) de telle façon que la section inférieure (36) dudit diffuseur est interposée entre ladite plaque de support (20) et ledit substrat d'interconnexion de circuit imprimé (14).

4. Ensemble selon la revendication 1 ou 3, également caractérisé par le fait que lesdits moyens de fixation élastiques (42) comprennent un organe élastique (42, 43) disposé autour dudit diffuseur de chaleur (18) dans ledit trou de diffuseur (24) et à proximité dudit rebord annulaire (38), et qu'un organe de serrage (41) est assujetti audit diffuseur de chaleur (18) et interposé entre ledit organe élastique (42, 43) et ledit dissipateur de chaleur (28) afin que ledit organe élastique (42, 43) sollicite ledit organe de serrage (41) et ledit diffuseur de chaleur (18) en direction dudit dissipateur de chaleur (28).

5. Ensemble selon la revendication 4, également caractérisé par le fait que ledit organe élastique (43, 44) comprend une bague en caoutchouc (44) et un ressort en couronne (43) disposé à l'intérieur de ladite bague en caoutchouc (44).

6. Ensemble selon la revendication 1 ou 3, également caractérisé en ce que :

a. un conducteur (54) est prévu sur ledit diffuseur de chaleur (18), ledit conducteur (54) étant en contact avec ledit composant électronique (12); et

b. un conducteur (50) est prévu sur ladite plaque de support (20), ledit conducteur (50) étant relié électriquement au conducteur (54) dudit diffuseur de chaleur afin de définir un trajet électrique allant de ladite plaque de support (20) audit composant électrique (12).

7. Ensemble selon la revendication 6, également caractérisé par le fait que le conducteur (50) de ladite plaque de support est au moins partiellement disposé sur ladite surface inférieure de ladite plaque de support (20).

8. Ensemble selon la revendication 1, également caractérisé par une plaque de base (16) fixée audit substrat d'interconnexion formant plaquette de circuit imprimé (14) et disposée de telle façon que ce dernier est interposé entre ledit composant électronique (12) et ladite plaque de base (16).

9. Ensemble selon l'une quelconque des revendications 1 à 8, également caractérisé par le fait que ledit diffuseur de chaleur (18) possède sensiblement le même coefficient de dilatation thermique que le composant électronique (12).

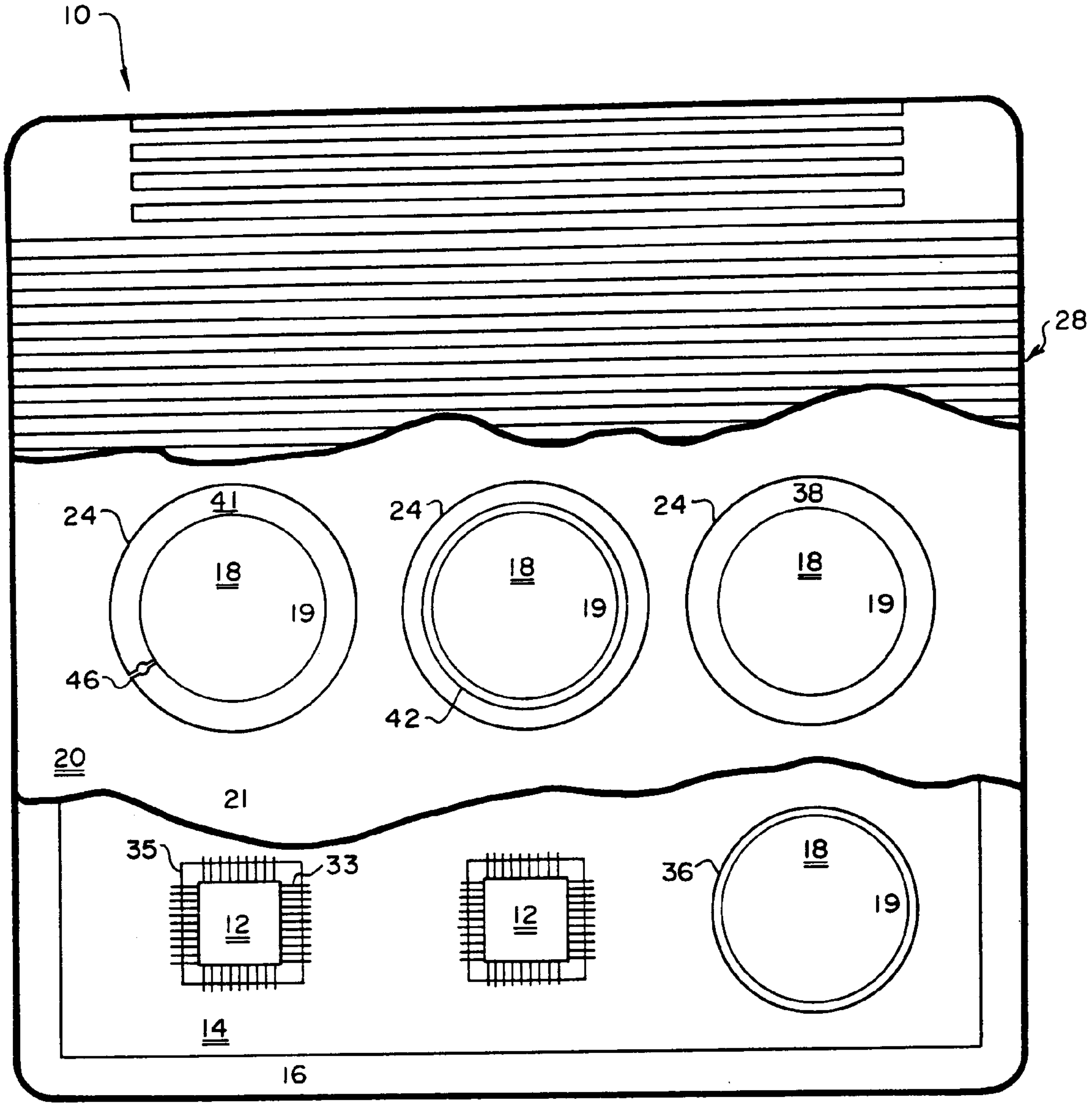
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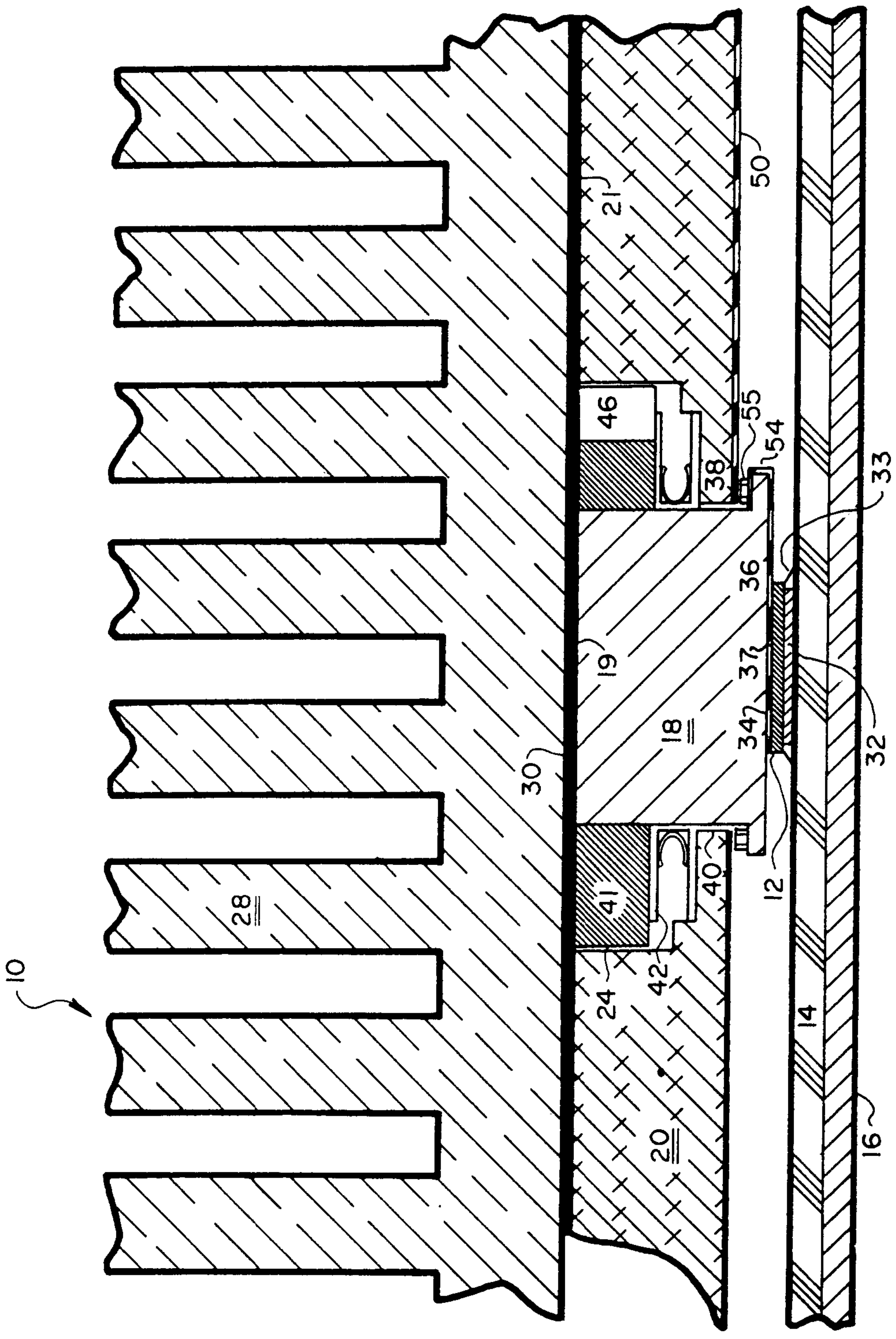
FIGURE 1

FIGURE 2



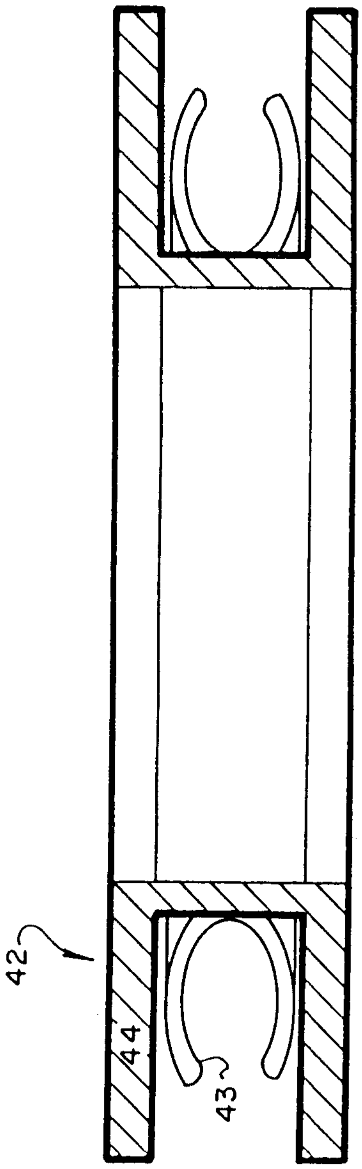


FIGURE 3